



# Developing a Decision Support Model for Buffelgrass Management in Southern Arizona

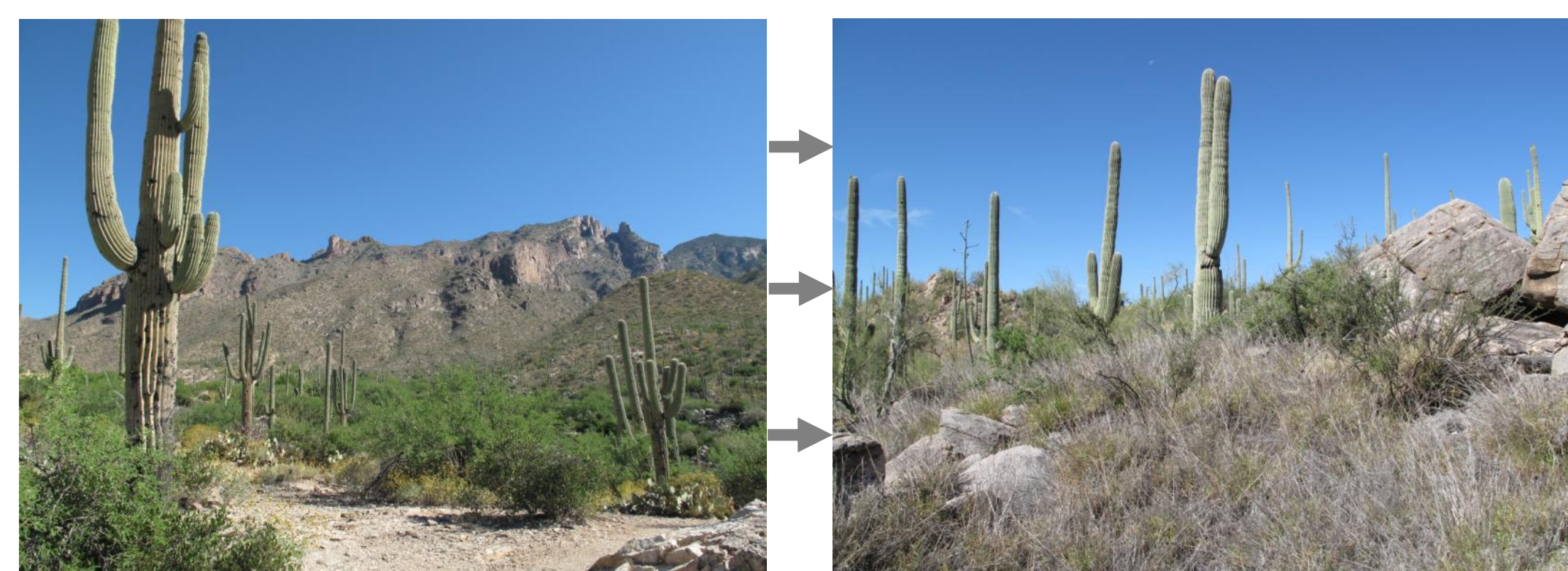
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**TELSA**  
 Tool for  
 Exploratory  
 Landscape  
 Scenario  
 Analyses

## Introduction

Buffelgrass poses an imminent threat to the Sonoran desert ecosystem and the human communities embedded within it. Its ability to fill an empty niche in the ecosystem and transform fire regimes could be catastrophic to both the biodiversity of this unique American landscape and to the safety of the people who live there. Given the urgency of the situation and the limited resources available, land managers need tools to evaluate the potential efficacy of alternative mitigation strategies. This study focused on the development of a spatially explicit model as a decision support system to evaluate such strategies.



## Values at Risk

- Public safety (fire hazard)
- Property (fire hazard)
- Biodiversity (species extirpation)
- Tourism (ecosystem damage)

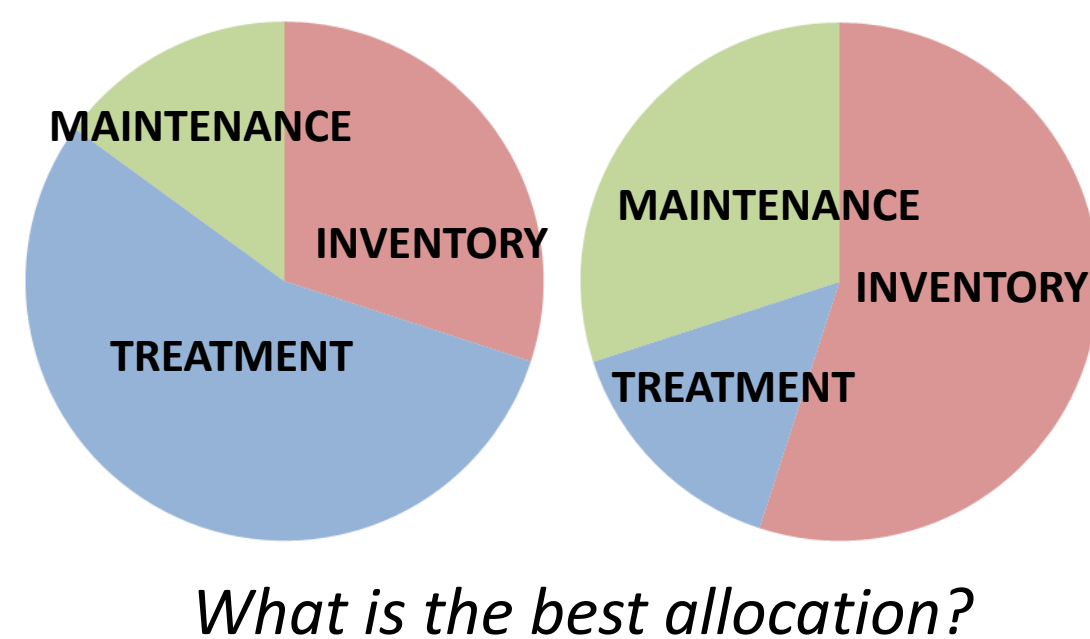


**Management must be cost effective**

## Management Trade-offs

There are limited resources to allocate among:

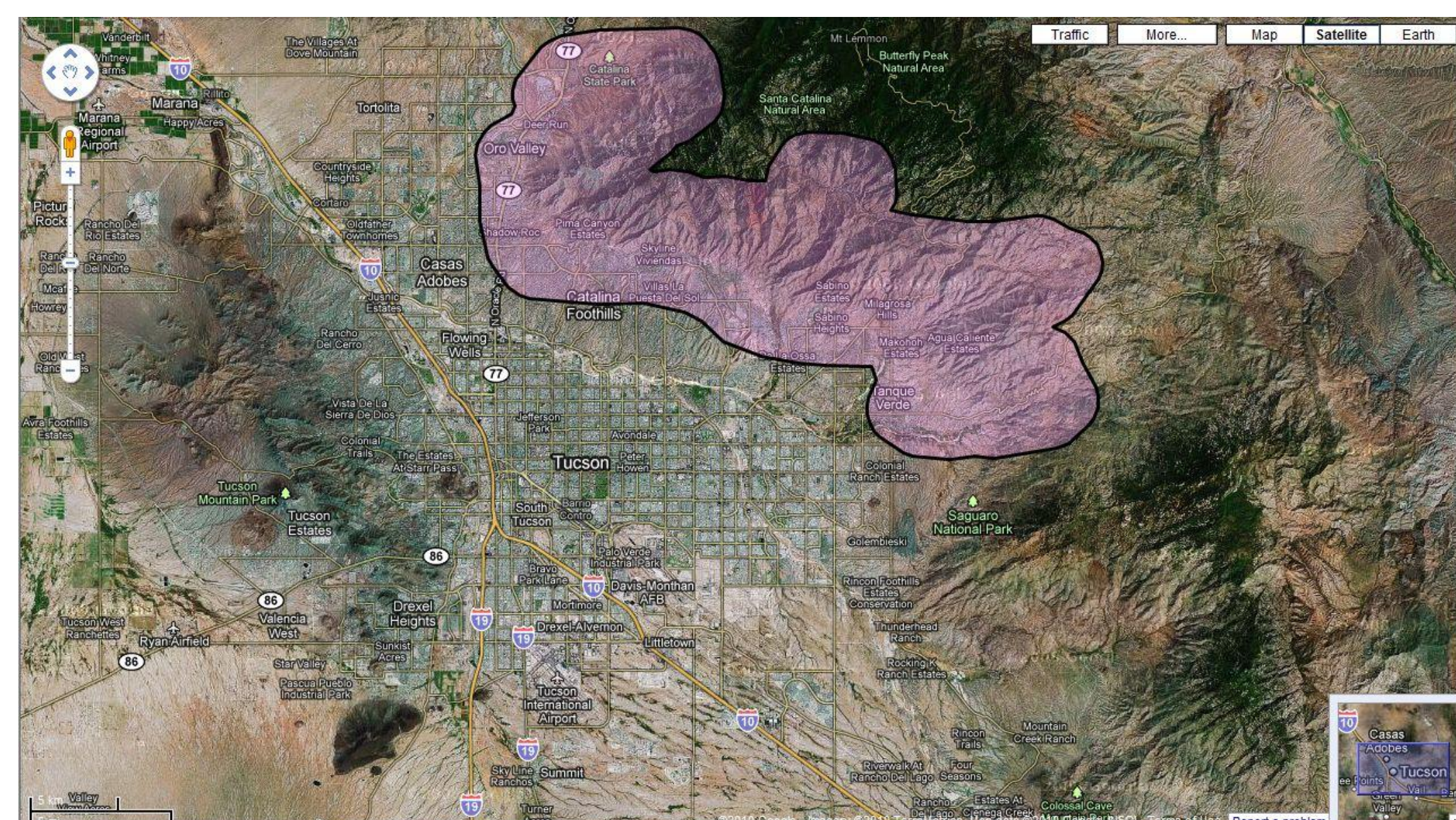
- Inventory
- Treatment
- Post-treatment Maintenance



## Study Area

Catalina Mountains — north of Tucson, Arizona

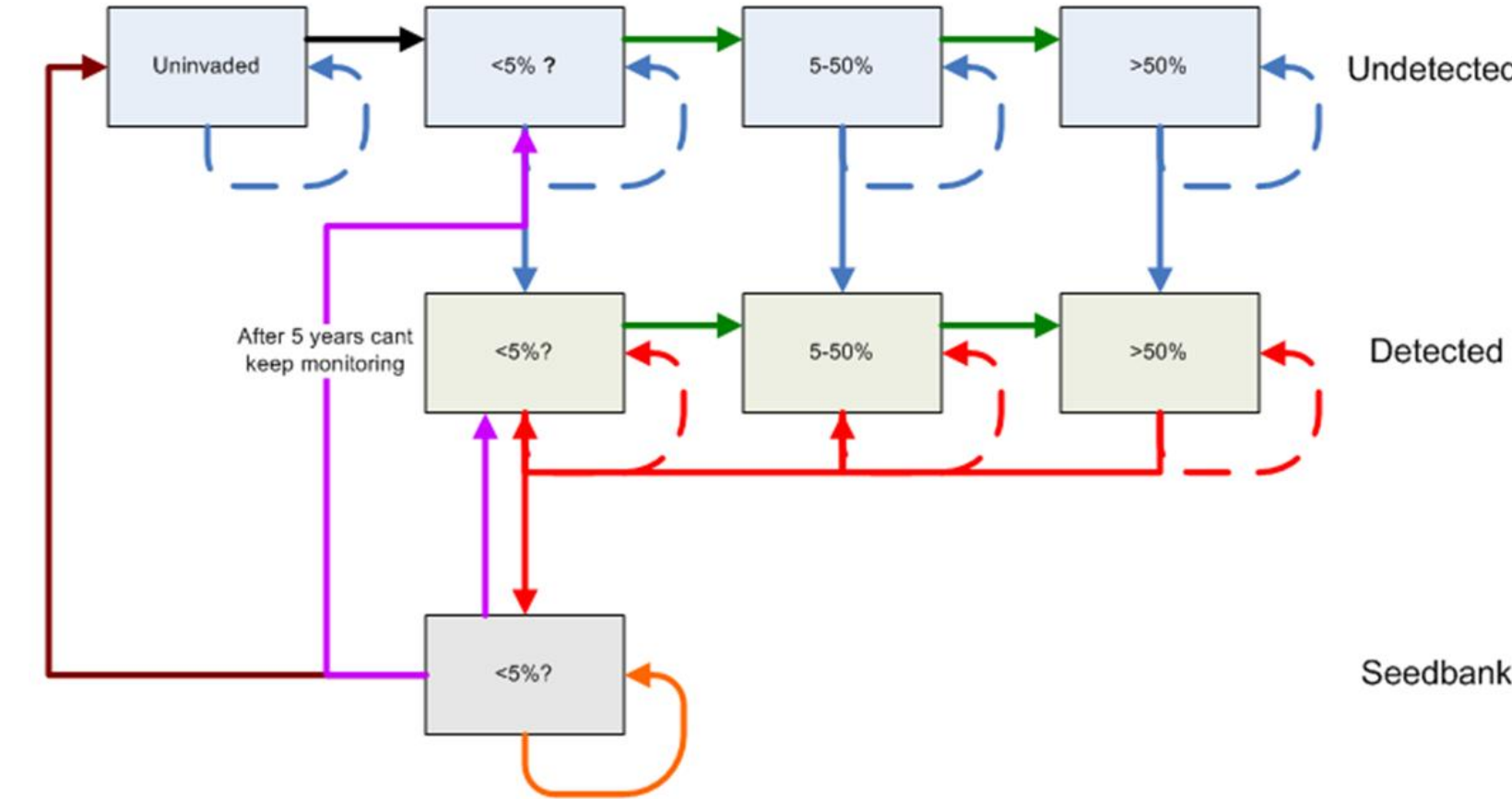
- Available data from field surveys
- Buffelgrass has predominantly remained unmanaged
- Small area (46,000 ha) suitable for prototype model



## Methods

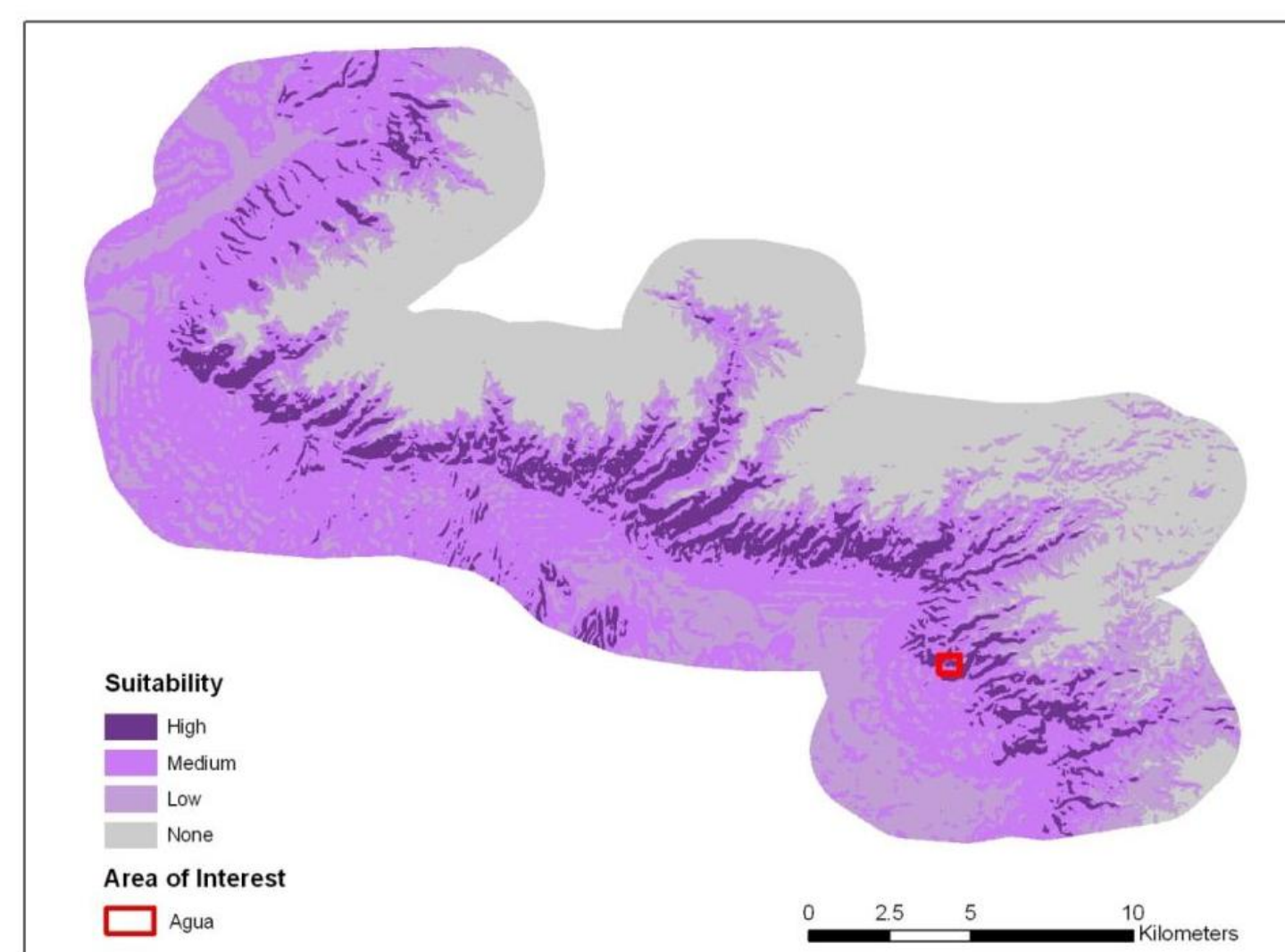
### TELSA State and Transition Model

- Describes all possible alternative states for each simulation polygon
- Describes all possible transitions that will result in a change in state



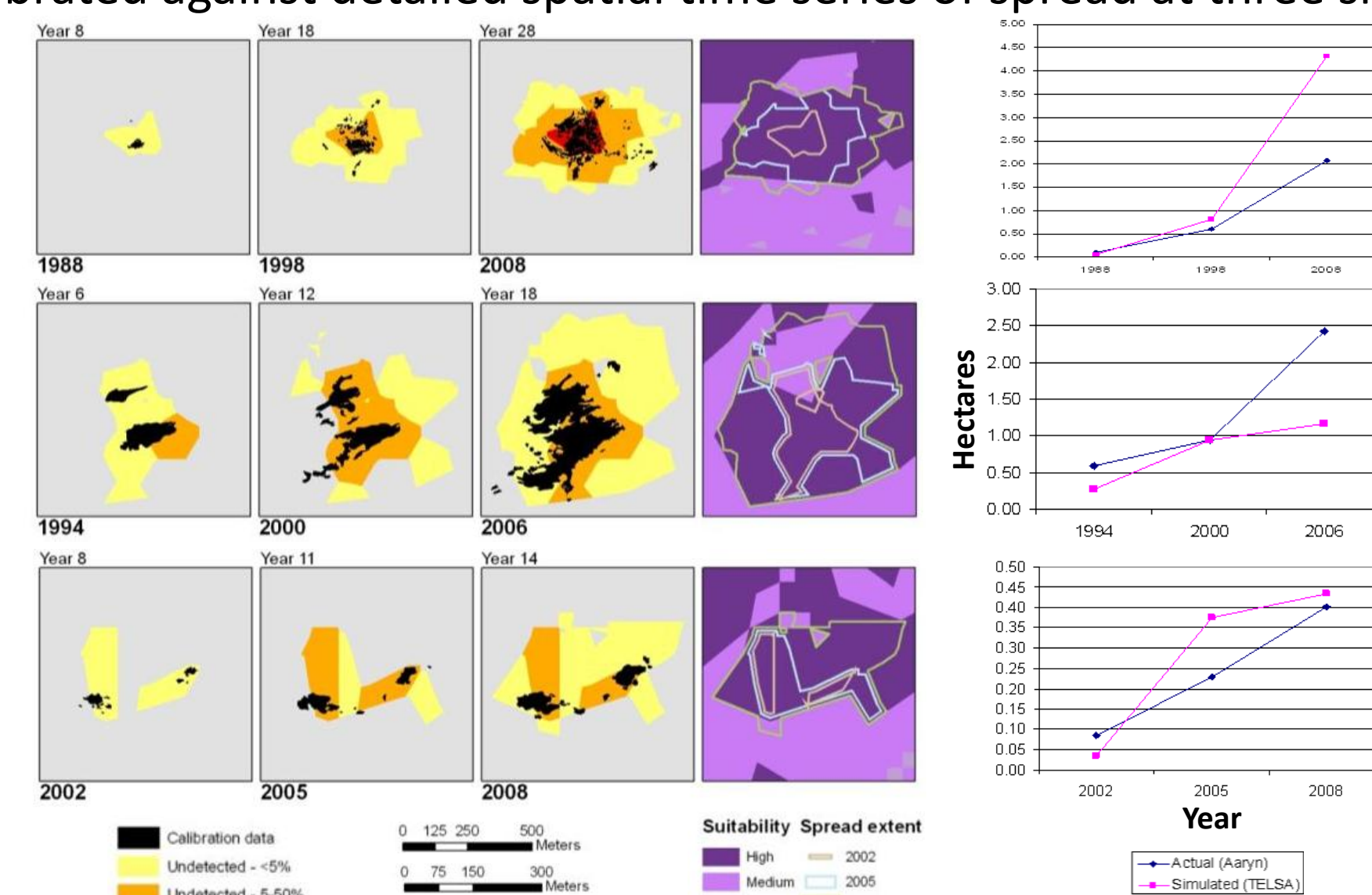
### Buffelgrass Habitat Suitability Model

- Developed by USGS Science Center, Fort Collins, CO
- Predominantly based on aspect and elevation criteria



## Calibration of the Model

- Calibrated against detailed spatial time series of spread at three sites



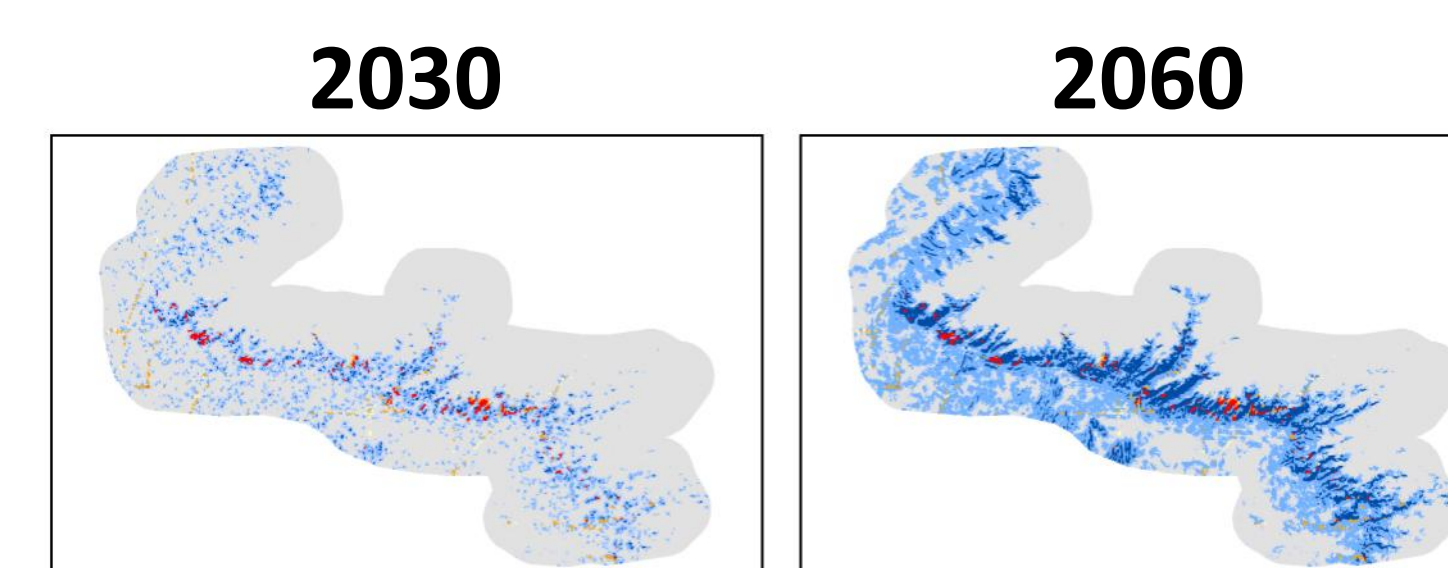
## Management Scenarios Simulated

Scenario	Management Effort	Effectiveness
A	None	-
B	Intermediate	Low
C	Intermediate	High
D	Unlimited	Low
E	Unlimited	High

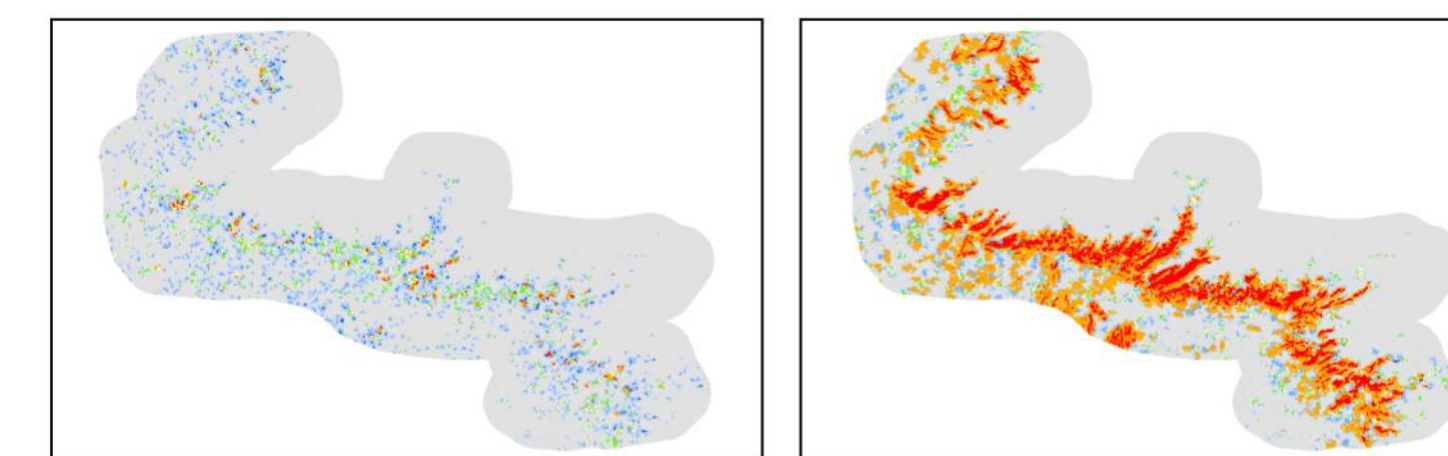
- Inventory and treatment success rates based on survey of land managers  
 “Low” effectiveness → 10<sup>th</sup> percentile of responses  
 “High” effectiveness → 75<sup>th</sup> percentile of responses
- “Limited management” → area limited to 50% the maximum area inventoried or treated in the “unlimited management” scenario
- “Unlimited management” → no restraints on management area

## Results

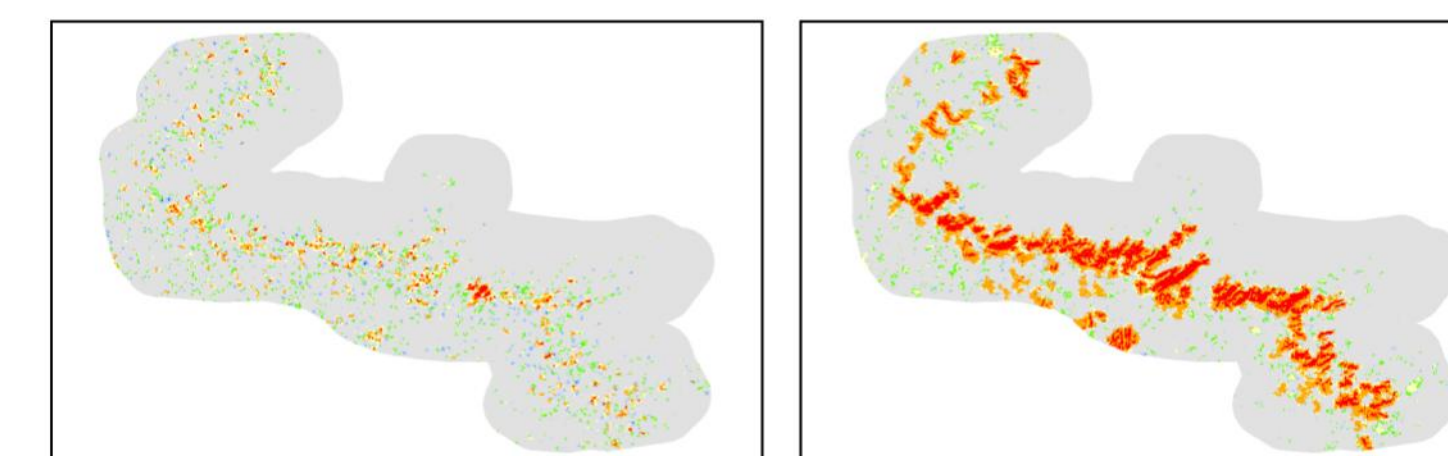
No Management



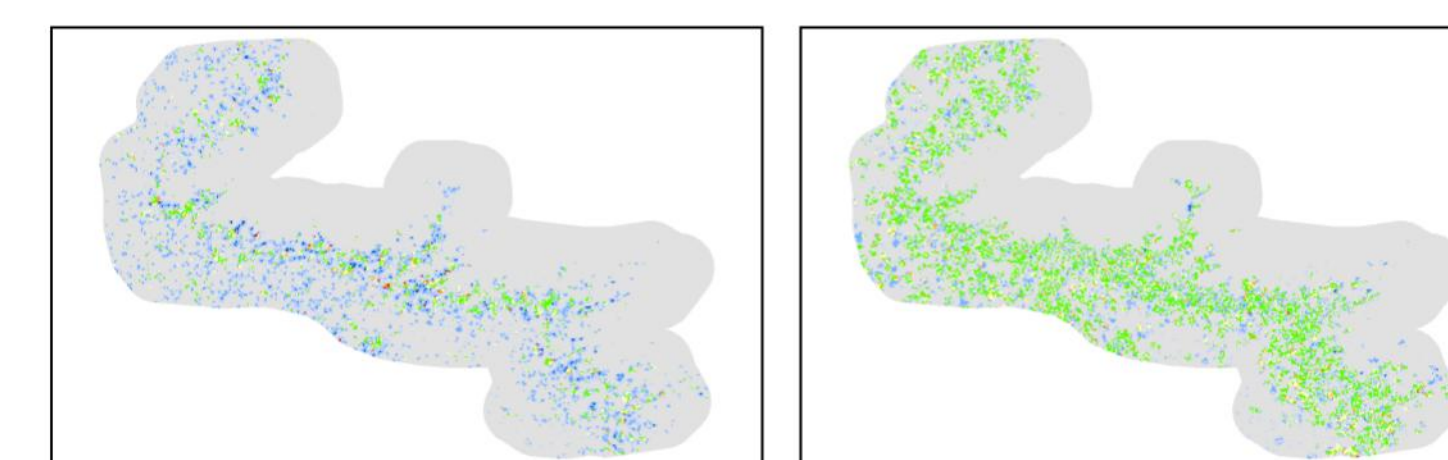
Intermediate Management / Low Effectiveness



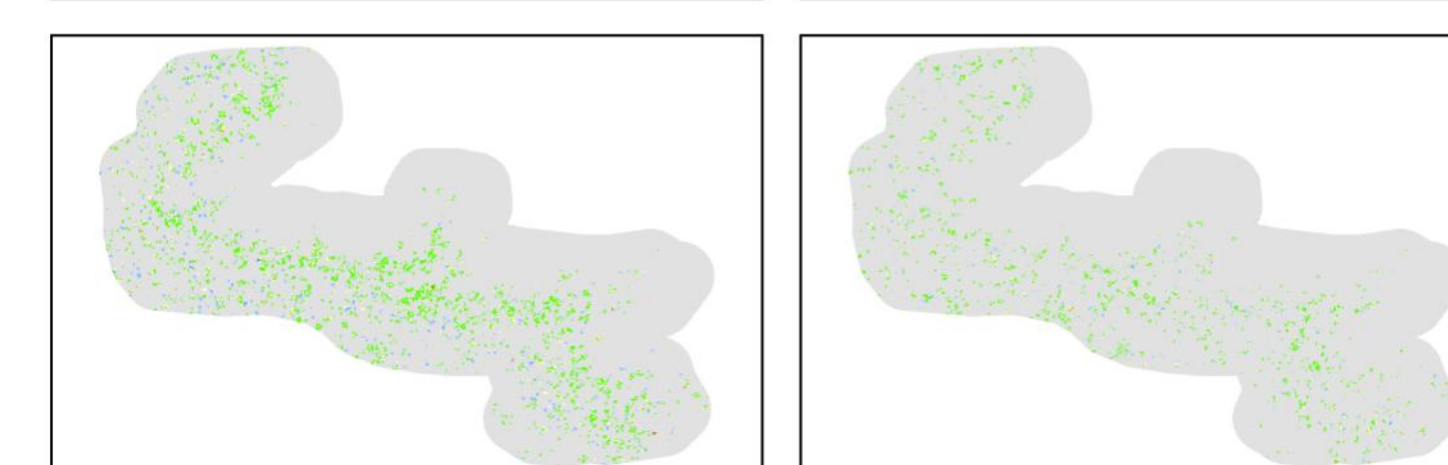
Intermediate Management / High Effectiveness



Unlimited Management / Low Effectiveness



Unlimited Management / High Effectiveness

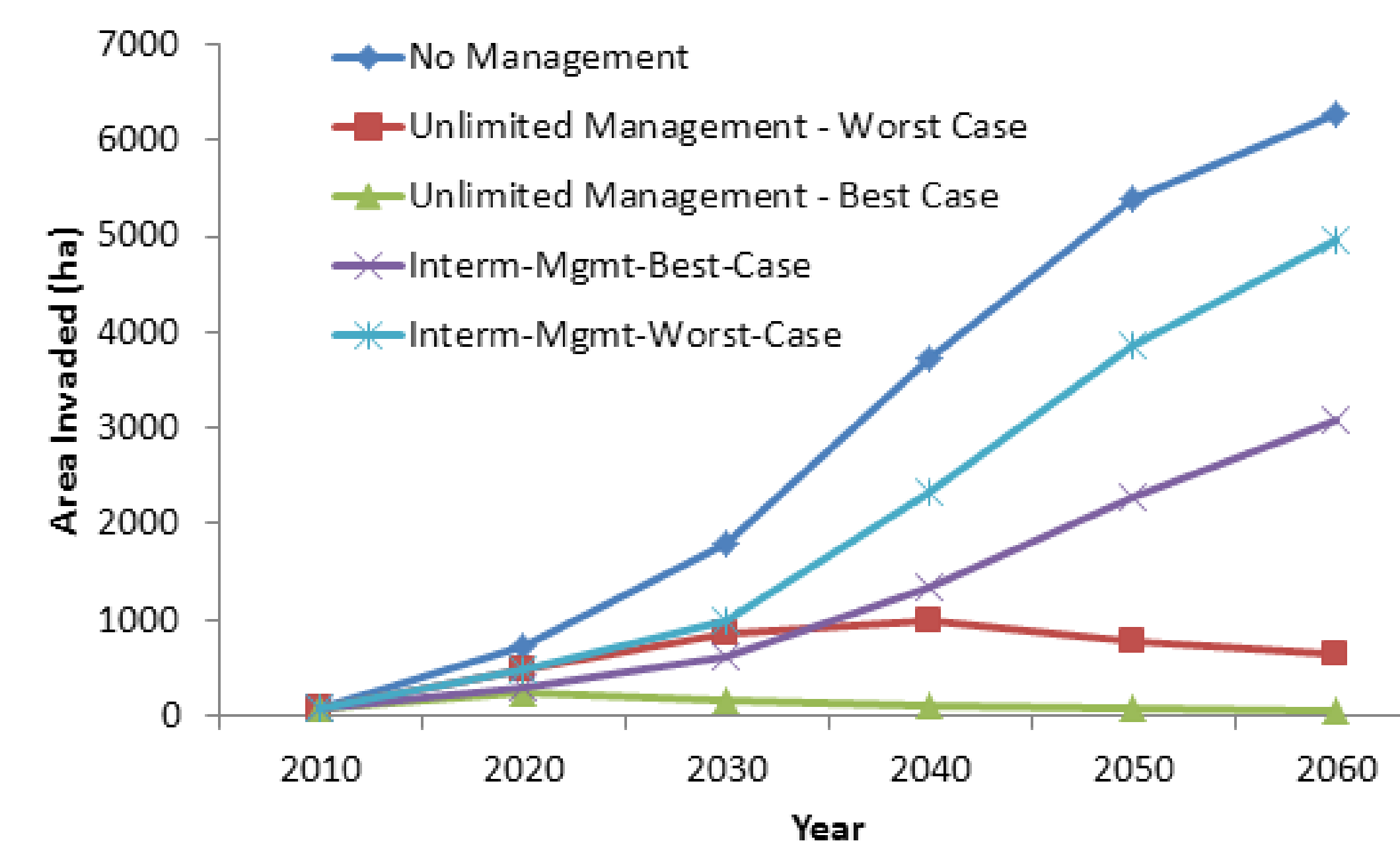


## Return on Investment

**Table 4:** Simulation results for area invaded by buffelgrass and cumulative area treated at years 2030 and 2060

Scenario	Year	Area Invaded (ha)	Cumulative Area Treated (ha)
Initial Conditions	2010	82	0
No Management	2030	1,795	0
	2060	6,263	0
Intermediate Management Worst Case	2030	997	682
	2060	4,952	3,157
Intermediate Management Best Case	2030	603	971
	2060	3,081	3,364
Unlimited Management Worst Case	2030	864	837
	2060	637	11,543
Unlimited Management Best Case	2030	159	1,460
	2060	54	3,752

## Area Invaded



## Conclusions

- ⇒ **With no management, buffelgrass will reach its ecological limits within 50 years.**
- ⇒ **If there is a tradeoff between allocating resources to treat more area or to increase the efficiency of treatment for smaller area, the latter may perform better.**
- ⇒ **Large upfront investment can substantially reduce the total management cost over the long term.**

## Questions for Further Analyses

- How accurate is the state and transition representation of how buffelgrass responds to treatment?
- What is the decay rate of the seedbank?
- Is it important to separate seed dispersal from establishment in the modeling process?
- Can we refine the buffelgrass dispersal kernel?
- Can we evaluate the economic benefits and costs of alternative buffelgrass management strategies?
- What is the most effective way to allocate management resources across space?
- What are the implications of alternative management strategies for the risk of fire to communities over time?
- Can we scale up our Catalina Mountains model to the broader region and use it as planning tool for buffelgrass mitigation and control strategies across federal lands in southern Arizona?

## Acknowledgements

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- We would also like to thank:
  - Marilyn Hanson, Dan Hatfield, Travis Bean, B.J. Cordova, Darrel Tersey, Dana Backer, and Sue Rutman for providing critical information on the effectiveness of inventory and treatment methods in the field.
  - Perry Grissom provided patch size distribution data for Saguaro National Park which was essential in defining the initial distribution of buffelgrass for the Catalina Mountains.
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  - The participants of the Buffelgrass Science Workshop for their contributions to the development of this decision support model (May 4-6, 2010, Tucson, AZ).

## Further Information

Please contact Leonardo Frid ([lfrid@essa.com](mailto:lfrid@essa.com))  
 More information on the TELSAs model and its application to other projects can be obtained at [www.essa.com/tools/telsa/](http://www.essa.com/tools/telsa/)

